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DECUS NO.	8-128
TITLE	PDP-8 OSCILLOSCOPE DISPLAY OF MATHEMATICAL FUNCTIONS
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DATE	May 29, 1968
SOURCE LANGUAGE	

PDP-8 OSCILLOSCOPE DISPLAY OF MATHEMATICAL FUNCTIONS

DECUS Program Library Write-up DECUS No. 8-128

These supplementary notes describe the procedures to be followed in using the Mathematical Display Program.

1. This program consists of two parts. The principal program is written in FORTRAN, and calculates and scales the table of values representing the function to be displayed. Display processing is carried out by a binary program which overlays the FORTRAN program. Transfers between both programs are automatically carried out.

2. The binary program (source written in PAL) is relocated by the FORTRAN program to occupy core locations above 7600, allowing a larger amount of data store. Because of this relocation the BIN loader will be clobbered. However RIM should remain untouched.

3. The loading procedure is as follows:

a) Load FORTRAN operating time system.

b) Load BINARY program through the FORTRAN operating system loader. This load will be OK even though there will be a check sum error. (Check sum in FORTRAN differs from that in PAL.)

c) Load FORTRAN OBJECT tape in usual way.

d) Begin FORTRAN program execution in usual way.

e) Allow about 1/2-minute for calculation of tabular values before display appears on oscilloscope.

4. The version of the FORTRAN program supplied is written to display a general fourth-order polynomial:

$$f(x) = Ax^4 + Bx^3 + Cx^2 + Dx + E$$

To display another function the user need only change this FORTRAN statement, which is line 90 of the FORTRAN program. If the function to be displayed does not require input variables A, B, C, D, E changes may be made in the input portions of the FORTRAN program which will allow longer function statements.

5. The display screen is treated as:

X-axis: mod 1000
Y-axis: mod 800

No attempt is made to obtain standard scale factors. Initially the user specifies the range of X, from which a scale factor for Y will be estimated. After viewing the display the user can respecify either X or Y ranges by typing CTRL F (simultaneously), which returns control back to the FORTRAN program.

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C; A. E. SAPEGA, S. G. WELLCOME  TRINITY COLLEGE, HARTFORD, CONN.
C;  TO RETURN TO FORTRAN PROGRAM FROM DISPLAY ROUTINE,
C; TYPE CTRL/F.

DIMENSION IXØ(1), IYØ(1), NX(25Ø), NY(25Ø)

C; THIS CALL RELOCATES BINARY PROGRAM
PAUSE 3828
GO TO 8Ø

C; THIS SECTION ALLOWS FOR CHANGE IN DISPLAY
8; TYPE 81
81; FORMAT (/,/,"NEW DELTA X? TYPE Ø
CHANGE Y SCALE? +1
NEW VARIABLES? -1 ")
ACCEPT 2Ø, K
2Ø; FORMAT (1)
IF (K) 8Ø, 111, 82
82; TYPE 83
83; FORMAT (/,/, "TYPE IN YMIN, YMAX ")
ACCEPT 2, YMIN, YMAX
GO TO 9Ø

C; THIS SECTION DATA INPUT
8Ø; TYPE 1
1; FORMAT (/,/,"TYPE IN A,B,C,D,E ")
ACCEPT 2, A, B, C, D, E
2; FORMAT (E)

111; TYPE 11Ø
11Ø; FORMAT (/,/,"TYPE IN XMIN, XMAX ")
ACCEPT 2, XLFT, XRYT
SIZE = XRYT - XLFT
XSF = 1ØØØ./SIZE
IXØ = -XLFT*XSF
DELX = SIZE/1Ø
X = XLFT
YMAX = 5.E1ØØ
YMIN = 5.E1ØØ
J = 1
DO 7Ø K = 1, 11
GO TO 1ØØØ
71; IF(YMAX-Y) 51, 7Ø, 5Ø
51; YMAX = Y
5Ø; IF(YMIN-Y) 7Ø, 7Ø, 52
52; YMIN = Y
7Ø; CONTINUE
```

```
9Ø; DELY = YMAX-YMIN
YINC = DELY/8.
YSF = 8ØØ./DELY
IYØ = -YMIN*YSF
TYPE 2Ø1, XLFT, XRYT, DELX
2Ø1: FORMAT (/,/,"XMIN = ",E,"XMAX =  ",E,"X/DIV. = ",E)
TYPE 21, YMIN, YMAX, YINC
21; FORMAT (/,/,"YMIN = ",E,"YMAX = ",E,"Y/DIV. = ",E)

C;   DO LOOPS 5 & 6 SET UP SCALE MARKS ON AXES
J = Ø
DO 5 K = 1, 22
NX(K) = J
NY(K) = IYØ - 1Ø
K = K + 1
NX(K) = J
NY(K) = IYØ + 1Ø
J = J + 1ØØ
5; CONTINUE
J = Ø
DO 6 K = 23, 4Ø
NY(K) = J
NX(K) = IXØ - 1Ø
K = K + 1
NY(K) = J
NX(K) = IXØ + 1Ø
J = J + 1ØØ
6: CONTINUE
DELX = SIZE / 21Ø.
X = XLFT
J = 2
DO 7 K = 41, 25Ø
1ØØØ; CONTINUE

C;       STATEMENT OF FUNCTION TO BE DISPLAYED
C;       THIS  IS AT LINE 9Ø

Y = X*(X*(X*(X*A+B)+C)+D)+E

X = X + DELX
GO TO (71, 72), J
72; XT = (X-XLFT)*XSF
YT = (Y-YMIN)*YSF
IF(YT) 1Ø, 11, 11
11; IF(YT-8ØØ.) 9,9,1Ø
9; NX(K) = XT
NY(K) = YT
GO TO 7
1Ø; NY(K) = 1ØØØ
7; CONTINUE
PAUSE 3968
DELX = SIZE/1Ø
GO TO 8
END
```

```
/A. E. SAPEGA, S. G. WELLCOME  TRINITY COLLEGE
/PROGRAM TO DISPLAY FORTRAN DATA
/AND XY GRID WITH MONITOR CALL OPTION.
/THIS PROGRAM IS MOVED TO *76ØØ BY PROGRAM
/MOVE GIVEN BELOW SO LOCATIONS 74ØØ-7576
/CAN BE USED FOR DATA STORAGE.

/PROGRAM TRANSFERS CONTENTS OF 74ØØ-7576
/TO 76ØØ-7676

*7364
MOVE, Ø
CLA
TAD I PROG
DCA I TOP
ISZ PROG
ISZ TOP
ISZ COUNT
JMP.-5
JMP I MOVE
PROG, 74ØØ
TOP, 76ØØ
COUNT, -115

*74ØØ
DISP, Ø
CLA
TAD I XORIG
DCA DX  /COORDINATES OF GRID CENTER FROM FORTRAN
TAD I YORIG
DCA DY
GRID, TAD XSET
DCA XCOUNT  /INITIALIZE X VARIABLES
DCA IXD
TAD DY
DYL             /SET Y BUFFER FOR X AXIS
CLA
DISPX, TAD IXD
DXS
TAD ADD
DCA IXD
ISZ XCOUNT  /DRAW X AXIS, CHECK IF IT'S FINISHED
JMP DISPX
TAD YSET
DCA YCOUNT  /INITIALIZE Y VARIABLES
DCA IYD
TAD DX
DXL             /SET X BUFFER FOR Y AXIS
CLA
DISPY, TAD IYD
DYS
TAD ADD
DCA IYD
ISZ YCOUNT  /END OF Y AXIS YET?
JMP DISPY
```

```
GRAPH, TAD ADRESX       /DISPLAY GRAPH POINTS CALCULATED
DCA XIND                /IN FORTRAN PROGRAM
TAD ADRESY
DCA YIND
LOOP, TAD I XIND
DXL
CLA
TAD I YIND
DYS
CLA
ISZ XIND
ISZ YIND
ISZ BTONT       /END OF GRAPH?
JMP LOOP
TAD CNTSET      /FINISHED GRAPH, RESET POINT COUNT
DCA BTONT

FLGCHK, KSF     /IS FLAG UP?
JMP GRID        /NO - DISPLAY AGAIN
KRB             /YES - READ TTY BUFFER
DCA IXD         /TEMPORARY STORAGE IN A CONVENIENT UNUSED BUFFER
TAD IXD
TAD MCTRLF      /IS IT A CTRL/F?
SNA CLA
JMP I DISP      /YES-RETURN TO FORTRAN
JMP GRID        /NO-DISPLAY AGAIN

XSET, -145      /X,Y AXIS LENGTH
YSET, -121
MCTRLC, - 203   / -CTRL/C
MCTRLF, - 206   / -CTRL/F
DX, Ø           /CENTER GRID COORDINATES, STORAGE
DY,Ø
ADD, 12         /GRID INCREMENT, 1Ø DECIMAL
XCOUNT, -145    /POINT COUNTS FOR AXES
YCOUNT, -121
IXD, Ø
IYD, Ø
XORIG, 7576     /INDIRECT JMPS FOR DX, DY
YORIG, 7575
ADRESX, 7203    /INDIRECT JMPS FOR GRAPH POINTS
ADRESY, 6611
XIND, 7203
YIND, 6611
PTONT, -372     /OCTAL 25Ø DECIMAL
CNTSET, - 372
DXL=6053
DYL = 6063
DXS=6057
DYS=6067
$
```